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AN EVALUATION OF DRUDGERY REDUCING AGRICULTURAL TECHNOLOGIES DEVELOPED FOR FARM WOMEN

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ABSTRACT

The rural women play a significant role in agriculture and other agro based activities. The daily work schedule of rural women is very demanding and arduous. It is estimated that women on an average work for about 8-9 hours/day in agricultural operations like weeding, transplanting, harvesting, threshing and storage etc. and an average of4 hours in household activities. To estimate the drudgery 30 farm women was selected of age range 30 years to 40 years. There anthropometric measurements were calculated and the average height, weight and body mass index was 151.5 cm, 50.5 kg and 23.4 respectively. The amount of drudgery while performing agricultural activities traditionally and manually was studied and the results indicates that the amount of energy spent by the farm women while performing selected activities with the improved technologies was low when compared to the traditional methods. It was also found that with the help of modified technology, the work output and work efficiency increased. The rate of drudgery while weeding and transplanting was moderate in term of perceived rate of exertion as compared to be heavy in case of traditional method.

KEYWORDS: Overall Discomfort Rate (ODR) & Ergonomic Parameter

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Original Article

INTRODUCTION

Women play an important role in Indian Agriculture. Women are doing 70% of major farm work and constitute 60% of the farming population (NSWF, 2014). In India, out of 30 million women work force, 20 million live in rural areas. The rural women play a significant role in agriculture and other agro based activities. The daily work schedule of rural women is very demanding and arduous. It is estimated that during peak period, women work every day for about 8-9 hours in agriculture and 4 hours in household activities and there are certain agricultural operations in which female agricultural workers are considered better than male workers (Suma Haslkar et al., 2005).

Women carry out many jobs as weeding, transplanting, harvesting, threshing and storing grains and providing fuel and water (Swaminathan, 1993). These tasks often have serious consequences for women due to the uncomfortable technologies of performance. Women's plays a major role in weeding operation; it is an essential operation in agriculture to prevent undesired species from growing and consuming the key resources (i.e. water, minerals, soil and sunlight) and thereby compromising crop yield. Farmers spend a large amount of time and money managing weeds. They aggressively compete for water, nutrients and sunlight, which result in lower crop yield and produce poor crop quality (Oerke, 2006). In India the annual losses due to weeds in food grains is about 82 million tons, pulses 14 million tons, oil seeds 12 million tons and commercial crops about 52 million tons

(P. K. Singh, 2013).

Ergonomics is a branch of science that work for easing the task of farm women by equipment and knowledge surroundings that will suit each worker (Rajendran and Reddy, 2013).

This case study is based on the works done by YFA- KVK, Wanaparthy District in introducing drudgery reducing implements in various agricultural activities like weeding, transplanting, sowing etc.

The objectives of the present study were

- To examine the efficiency of work improved technologies over traditional methods.
- To test the ergonomic parameters over various improved agriculture technologies to reduce fatigue of workers.
- To examine exertion by farm women in both methods by overall discomfort rating (ODR).

MATERIALS AND METHODS

The study was conducted in the selected villages of Pebbair, Kothakotamandals of Wanaparthy district during 2017 -2018 with the objective to reduce the workload of farm women through various Agricultural technologies. Four improved technologies were selected for four different agricultural activities shown in Table 1.

Table 1: Various Improved Agriculture Technologies Introduced for the Drudgery Reduction

S.no	Improved Agriculture Technology	Activity
1	Long handle weeder	Weeding
2	Sapling transplanter	Transplantation of vegetables sampling
3	Ground nut stripper	To Separate the pods from plants
4	Seedplacement tube	Sowing of seeds

The selected technologies were tested on thirty farm women, with the normal blood pressure, body temperature and with normal respiration.

The tools used for the ergonomic analysis are heart rate monitor, thermometer, blood pressure monitor, weighing machine, anthropometric rod and measuring tape. The physical characteristics like age, stature height, weight and blood pressure were recorded. The heart rate was compared while working with traditional and improved technologies to assess the drudgery of women.

The BMI score of all the thirty women calculated as per ICMR (2010) classification. Each farm women were tied heart rate monitoring machine to record the heart rate at every minute. The heart rate of worker was noted at every minute when they were asked to do work for 30 minutes. Then break of 5 minutes was given and again the heart rate normal condition was noted. Heart rate during various activities like work and relaxing time was recorded.

Average Heart Rate during Rest and Work

ΔHR (beats/min) = Average working heart rate (WHR) – Average heart rate during rest.

For calculation of the Energy Expenditure Rate of heart rate, the Varghese (1994) equation was used which is as follows.

EER (kj/min) = 0.159* HR (beats/min) – 8.72.

Output = kg/hour

Overall, discomfort rating (ODR) was taken on a 10-point psychophysical rating scale (0= no discomfort, 10 = extreme discomfort) which is an adoption of Corlett and Bishop (1976) technique.

Total cost of work (TCW) and Physiological cost of work (PCW) were determined by using the average heart rate during rest at work, recovery and duration of the work.

$$Physiological\ Cost\ of\ Work = \frac{Total\ Cost\ of\ Work}{Duration\ of\ Work\ (min)}$$

Total Cardiac Cost of Work (TCCW) = Cardiac cost of work (CCW) + Cardiac cost of recovery (CCR)

CCW = (Average working heart rate – Average resting heart rate) * Duration of work (min)

CCR = (Average recovery heart rate – Average heart rate) * Duration of recovery (5 min)

Cardiac cost of worker per unit of output (beats/kg) = ΔHR * duration/output.

Classification of Workload

Varghese in 1994 classified workload of activity in different occupation shown in Table 2.

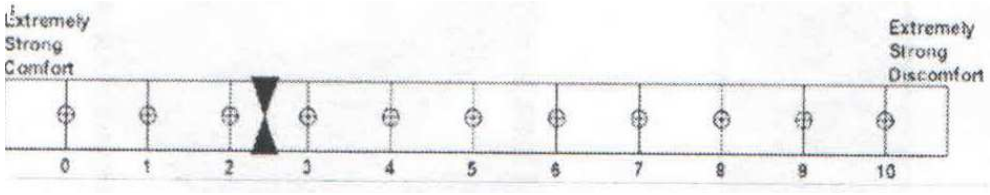
Table 2: Classification of Workload

Physical Work Load	Physiological Variables	
	Energy Expenditure (Kj/min)	Heart Beats(Beats/min)
Very Light	Upto 5.0	Upto 90
Light	5.0-7.5	91-105
Moderate	7.6-10.0	106-120
Heavy	10.0-12.5	121-135
Very Heavy	12.6-15.0	136-150

Overall Discomfort Rating (ODR)

Overall, discomfort rating (ODR) had been defined by using a 10-point psychophysical rating scale. There was a movable pointer on it. After each experience subjects indicated the comfort level on this scale (Figure 1). At the end of each trial averages of overall discomfort rating values had been calculated.

Overall, discomfort rating (ODR) was assessed by using the scale used which was developed by Corlett and Bishop (1976) for the assessment of it. It consisted of a 70cm long graduated scale with its left marked as 0 and right 10 which are represented ‘no discomfort’ and ‘extreme discomfort’, respectively. A sliding pointer was provided on the scale to mark the level of discomfort. At the end of each trial subject was asked to mark their overall discomfort rating on the scale. The overall discomfort rating given by each of the thirty subjects was averaged to get the mean rating (Sam and Kathirvel, 2008).



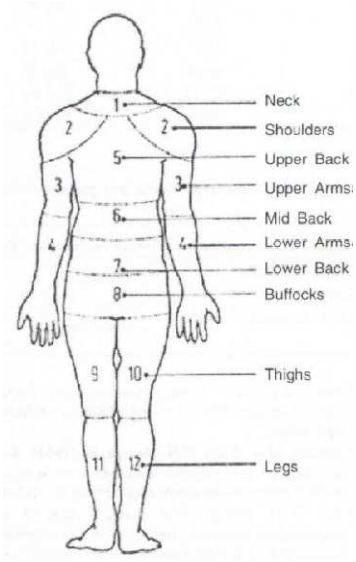


Figure 1

Rating of Perceived Exertion

Pain is the indicator of discomfort. The perceived discomfort was recorded in terms of pain felt in different parts of the body by the subjects while performing the activity. The Rating Exertion scale development was used to subjectively assess the exertion perceived. The experiment was conducted at different time intervals of the day between 9:00 AM and 5:30 PM. The trials were given in randomized order to minimize the effects of extraneous factors. Each subject had a rest for 15 minutes before starting the trial. Subjects were asked to indicate ODR and perceived exertion assessments after working period. The same procedure was repeated three times for all the selected subjects.

Statistical Analysis

Mean and standard deviation for three parallel replicates were calculated. Analysis of variance (ANOVA) was used to test the difference between means (Snedcor and Cochran, 1983)

RESULTS AND DISCUSSIONS

Thirty farm women of adopted villages of youth for Action- KVK, Madanapuram, Pebbair, Kothakota mandals of Wanaparthy district "Reducing of workload of women in various Agriculture technologies" were randomly selected for the study. The results are as follows.

Physical Characteristics of the Respondent

Basic anthropometric data of the subjects have been presented in Table 3. As shown in the table, the average age of the selected thirty farm women was 37.2 years. The average height was 151.5 cm. And the average body weight was 50.5 kg. The mean body mass index was 23.4 indicating that they were normal.

The drudgery can be defined as physical & mental strain, fatigue, monotony and hardship experience by farm women while doing weeding operations (Kumar *et al.*, 2011).

Table 3: Mean Value of Physical Characteristics of the Selected Sample for Ergonomic Evaluation of Four Improved Agriculture Technologies

Improved Technology	Mean value of Physical Characteristics of the Subjects Selected for the Study		
	Age	Height(cm)	Weight(kg)
Long handle weeder	36.3	152.5	54.3
Sapling transplanter	37.6	150.4	46.2
Ground nut stripper	39.75	151.2	52.25
Seedplacement tube	35.6	150.5	49.6

Among the four traditional agricultural activities, maximum average heart rate of **107.8** per min was observed while performing weeding with traditional tool, among the activities with improved implements, use of long handle weeder in vegetable recorded maximum average heart rate **101.8** per min, followed by use of sapling transplanter for transplanting of tomato recorded **97.6** per min. Similarly, results were observed for Energy expenditure also as depicted in Table 4.

The physiological cost of work was observed to be less with the improved Sapling Transplanter, long handle weeder, groundnut stripper and Seed placement tube compared to the use of traditional methods for Transplanting, weeding, groundnut stripping and sowing activities respectively.

Table 4: Mean Value of Circulatory Stress and Physiological Parameters of the Respondents while Working with the Traditional and Improved Agriculture Technologies

S. No	Improved Technologies	Working Heart Rate (Beats/min)		Energy Expenditure (Kj/min)		Total Cardiac Cost of Work (Beats/min)		Physiological Cost of Work (Beats/min)	
		I	T	I	T	I	T	I	T
1.	Long handle weeder	101.8	107.8	7.48	8.39	475.2	1140	17.26	23.31
2.	Sampling transplanter	97.6	102.8	6.78	7.61	292.2	944	7.3	17.23
3.	Ground nut stripper	94.03	99.21	6.23	7.06	167.23	232.92	5.59	7.74
4.	Seed placement tube	95.81	99.35	6.41	7.05	224.8	470.8	95.81	99.35

T- Traditional I = Improved Kj/min=kilo jouls per min.

The work output of various agricultural activities with the traditional and improved technologies. Almost all the improved technologies have given a better work output than the traditional technologies except the seed placement tube as presented in Table 5. Maximum increased work output was observed with the Long handle weeder, followed by use of sapling transplanter and groundnut stripping activities, respectively. The work output was observed to be similar with the use of seed placement tube alone compared to the traditional method of sowing of seeds.

Table 5: Work Output of the Respondents while Performing the Agriculture Activities with the Traditional and Improved Agriculture Technology

Agriculture Technologies	Improved Technology Method	Traditional Method
Long handle weeder	62.9m	32.7m
Sapling transplanter	56.7m	46.2m
Ground nut stripper	6.5kg	2.4 kg
Seed placement tube	50.2m	48.9m

Weeding, transplanting and Groundnut stripping activities are time taking as it has been performed for hours together continuously. Because of these activities the musculo-skeletal problems are leading encountered. Due to

continuous sitting posture, the results observed with overall discomfort rating are presented as shown in Table 6.

Table 6: Mean Value of Overall Discomfort Rating (ODR), Responses on Muscular-Skeletal Problems and Perceived Exertion Experienced by Respondents Overall Discomfort Rating (ODR)

Agricultural Technology	Overall Discomfort Rate (ODR)		Musculo- Skeletal Pain (MSP)		Rating of Perceived Exertion (RPE)	
	I	T	I	T	I	T
Long handle weeder	4.65	7.52	Moderate to light pain in shoulder, hands and arms	Severe pain in upper back, hands and fingers	Moderate	Heavy
Sapling transplanter	4.44	8.01	Moderate to light pain in shoulder, hands and arms	Severe pain in upper back, hands and fingers	Moderate	Heavy
Ground nut stripper	3.57	7.44	light pain in shoulder, hands and arms	Severe pain in upper back, hands and fingers	Light	Moderate
Seed placement tube	4.12	5.14	light pain in shoulder, hands and arms	Severe pain in upper back, hands and fingers	Light	Moderate

T- Traditional I = Improved

Musculo-skeletal problems and posture were evaluated by asking the respondents as to where they felt pain in their body after weeding, Groundnut stripping and transplanting activities with traditional and improved technology.

As a result, the working efficiency of the workers is greatly reduced. Working in squatting posture for longer period might be the reason that almost all the woman reported severe to moderate discomfort in the lower back, knees, upper back, ankles knees, feet and neck. So, the women perceived the task as a heavy and the other hand by using long handle Weeder, they felt light discomfort, pain in shoulder, hands, arms and there was no back pain reported.

CONCLUSIONS

By adopting these improved technologies for weeding, transplanting, groundnut stripping activities and sowing, the farm women has soon increase in their work output and reduce the drudgery. Hence by the above study it can be concluded that the reduce drudgery and time while using the improved technologies has fetched postural comforts and increased their income which in turn improved farm women's livelihood and health.

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